Hantavirus

(Also known as Hantavirus Pulmonary Syndrome and Hantavirus Disease)

May 2003

1) THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Hantaviruses are agents for several diseases, but only one disease is naturally occurring in the United States. Several different hantavirus species exist, each associated primarily with a single rodent species. One disease caused by hantaviruses is hemorrhagic fever with renal syndrome (HFRS). The disease occurs mainly in rural areas of Asia and the Balkans and is caused by Hantaan virus. The Puumala virus causes milder HFRS in Europe. Seoul virus, which is widely distributed, also causes HFRS of variable severity.

Hantavirus pulmonary syndrome (HPS) occurs in the US. There are several hantaviruses associated with HPS. Sin Nombre virus (SNV), Black Creek Canal virus, Bayou virus; New York-1 virus is similar to SNV. Most cases of HPS have been associated with the Sin Nombre virus.

B. Clinical Description and Laboratory Diagnosis

HPS is an acute febrile illness that progresses rapidly to severe respiratory failure (acute respiratory distress syndrome or ARDS) and shock. Initial symptoms are nonspecific flu-like symptoms, including fever, fatigue, and muscle aches, especially in the large muscle groups. Gastrointestinal manifestations or dizziness may also accompany these symptoms. As the disease progresses, symptoms can include cough and shortness of breath. Once the cardiopulmonary phase begins, the disease progresses rapidly, necessitating hospitalization and often assisted ventilation within 24 hours. Renal failure and hemorrhagic manifestations, common in HFRS, have been mild or absent in most recognized cases of HPS. The mortality rate is still not well defined but appears to be approximately 40–50%. In survivors, recovery from the acute illness is rapid with apparent restoration of normal lung function.

Laboratory diagnosis is based on identification in patients serum antibodies to hantaviruses using enzyme-linked immunosorbent assay (ELISA), Western blot assay, recombinant immunoblot assay (RIBA), or/and in patients tissues specific hantaviruses DNA using polymerase chain reaction (PCR) or antigens using immunohistochemistry.

C. Reservoirs

The main reservoir for Sin Nombre virus is the deer mouse, *Peromyscus maniculatus,* native to most of the United States. Black Creek Canal virus is associated with the cotton rat, *Sigmodon hispidus*, found in the Southeast. The rice rat, *Oryzomys palustris*, found in the southern United States, acts as a reservoir for Bayou virus. In the northeastern states, the white-footed mouse, *Peromyscus leucopus,* and the deer mouse have been associated with New York-1. The white-footed mouse is common throughout New Jersey, while the deer mouse may be found in the far northern parts of the state. A serologic survey of small mammals conducted in 1996 in cooperation with the NJ Division of Fish and Wildlife and CDC indicated that <5% of the white-footed mice had been exposed to the Sin Nombre virus.

D. Modes of Transmission

Infected rodents shed live virus in their saliva, feces and urine. Humans are infected when they inhale dust that contains dried contaminated rodent urine or feces. Transmission may also occur when dried materials contaminated by rodent feces or urine are disturbed and are directly introduced into broken skin or the eyes, nose or mouth. There is no evidence of person-to-person transmission of HPS in the United States.

E. Incubation Period

Since HPS is relatively uncommon, the incubation period has not yet been well defined, but it is believed to range from about 1 to 6 weeks after exposure, with an average of about 2 weeks.

F. Period of Communicability or Infectious Period

There has been no evidence of person-to-person spread of this disease in the United States.

G. Epidemiology

Sin Nombre virus (SNV) is the agent responsible for the 1993 HPS epidemic in the Southwest. Black Creek Canal virus was implicated in a single HPS case in Florida. Bayou virus was discovered from cases in Louisiana and Texas. New York-1 virus is similar to SNV, but it is distinct enough to suggest that it is a variant found in the eastern third of the United States. Most cases of HPS have been associated with the Sin Nombre virus.

HPS was first recognized in 1993; approximately 286 cases have been identified in the United States as of July 23, 2001. Cases have been reported in 31 states, including most of the western half of the country and some eastern states as well. About 75% of patients with HPS have been residents of rural areas. The distribution of identified cases reflects a spring-summer peak seasonality, although cases have occurred throughout the year. Cases of HPS have also been reported in Canada and in several countries in South America. Any person whose occupational activities (biologists, pest-control workers, etc.) or recreational activities (hikers, campers, etc.) put them in frequent contact with rodents or their droppings is potentially at risk of disease. Disturbing or inhabiting closed, actively rodent-infested structures is an important risk factor for contracting HPS. In New Jersey, there had not been any confirmed cases of HPS, as of August 1, 2003. The white-footed-mouse, a reservoir species for the virus, is the most common woodland mammal in the state and readily enters homes, particularly in suburban and rural areas. Therefore, residents of infested buildings, as well as persons involved in the occupational and recreational activities noted above, are at potentially elevated risk of disease.

2) REPORTING CRITERIA AND LABORATORY TESTING SERVICES

A. New Jersey Department of Health and Senior Services (NJDHSS) Case Definition

CASE CLASSIFICATION

A. CONFIRMED

A clinically compatible case, **AND**

- Detection of hantavirus-specific IgM or rising titers of hantavirus-specific IgG, **OR**
- Detection of hantavirus-specific ribonucleic acid sequence by polymerase chain reaction in clinical specimens, **OR**
- Detection of hantavirus antigen by immunohistochemistry

B. PROBABLE

Not used.

C. POSSIBLE

Not used.

NOTE: To include a case in the National HPS Registry, the Special Pathogens Branch of the Centers for Disease Control requires two diagnostic specimens and other information. The surveillance and reporting system for HPS requires that the NJDHSS be consulted before any specimens are submitted.

B. Laboratory Testing Services Available

The Public Health and Environmental Laboratories (PHEL) do not provide services for hantavirus testing. PHEL will make arrangements with the Centers for Disease Control (CDC) for hantavirus testing with appropriate authorization from the NJDHSS Infectious and Zoonotic Diseases Program. For information on appropriate sample submission call the Virology Laboratory at 609.984.2622.

3) DISEASE REPORTING AND CASE INVESTIGATION

A. Purpose of Surveillance and Reporting

- To assess the magnitude of the disease in different areas and among different risk groups.
- To identify individual cases or outbreaks as soon as possible.
- To identify rodent sources of infection.
- To monitor the emergence of HPS in new areas and new risk groups.
- To design more effective control or prevention methods.

B. Laboratory and Healthcare Provider Reporting Requirements

The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that laboratories report (by telephone, confidential fax or in writing) all cases of hantavirus infection to the local health officer having jurisdiction over the locality in which the patient lives, or, if unknown, to the health officer in whose jurisdiction the health care provider requesting the laboratory examination is located. The health care providers must report all cases of hantavirus infection to the local health officer having jurisdiction over the locality in which the patient lives.

Physician or hospital reporting possible case of HPS should contact the NJDHSS Infectious and Zoonotic Diseases Program at 609.588.3121 to receive and complete the CDC Hantavirus Pulmonary Syndrome Case Report form. The local health officer may be asked to assist in providing some of the information requested on the form (i.e., history of rodent exposure).

C. Local Departments of Health Reporting and Follow-Up Responsibilities

1. **Reporting Requirements**

   The New Jersey Administrative Code (N.J.A.C. 8:57-1.8) stipulates that each local health officer must report the occurrence of any case of hantavirus infection, as defined by the reporting criteria in Section 2 A above. Current requirements are that cases be reported to the NJDHSS Infectious and Zoonotic Diseases Program using an official form CDS-1. Report can also be filed electronically over the Internet using the confidential and secure Communicable Disease Reporting System (CDRS).

2. **Case Investigation**

   a. It is the local health officer's responsibility to complete the CDS-1 form or the report can be filed electronically over the Internet using the confidential and secure Communicable Disease Reporting System (CDRS). Most of the information can be obtained from the health care provider, the medical record or by interviewing the patient and others who may be able to provide pertinent information. Use the following guidelines in completing the report:

      1) Record "Hantavirus Disease" (or "Hantavirus Pulmonary Syndrome") as the disease being reported.
      2) Record the patient's demographic information.
      3) Record the date of symptom onset, symptoms, date of diagnosis, hospitalization information (if applicable), and outcome of disease (*e.g.,* recovered, died).
      4) Exposure history: use the approximate incubation period range for hantavirus (1-6 weeks). Specifically, focus on the period beginning about 1 week prior to the onset of disease date back to approximately 6 weeks before onset for the following exposures:
         a) Travel history: determine the date(s) and geographic area(s) visited by the case.
         b) Rodent contact: ask the patient about potential direct or indirect residential, occupational or recreational exposure to rodents and/or rodent droppings.
         c) Indicate where hantavirus was acquired. If unsure, state "Unknown." Include any additional comments regarding the case in the "Comments" section.

            NOTE: If CDRS is used to report, enter the collected information regarding exposure, travel, and any additional information into "Comments" section.

5) If there have been several attempts to obtain patient information (*e.g.,* the patient or healthcare provider does not return calls or respond to a letter, or the patient refuses to divulge information or is too ill to be interviewed), please fill out the form with as much information as possible. Please note on the form the reason why it could not be filled out completely.
6) Please to remind physician, or other person reporting possible case of HPS to contact the NJDHSS Infectious and Zoonotic Diseases Program at 609.588.3121 for CDC Hantavirus Pulmonary Syndrome Case Report form. The local health officer may be asked to assist in providing some of the information requested on the form (i.e., history of rodent exposure).

b. After completing the form, attach lab report(s) and mail (in an envelope marked "Confidential") to the NJDHSS Infectious and Zoonotic Diseases Program, or the report can be filed electronically over the Internet using the confidential and secure Communicable Diseases Reporting System (CDRS). The mailing address is:

NJDHSS
Division of Epidemiology, Environmental and Occupational Health
Infectious and Zoonotic Diseases Program
P.O. Box 369
Trenton, NJ 08625-0369

c. Institution of disease control measures is an integral part of case investigation. It is the local health officer's responsibility to understand, and, if necessary, institute the control guidelines listed below in Section 4, "Controlling Further Spread."

C. National Surveillance

a. NJDHSS reports possible cases of HPS to the Special Pathogen Branch, CDC for confirmation and inclusion in the surveillance system for Hantavirus infections maintained by the CDC.
b. Consultation with Public Health and Environmental Laboratories of NJDHSS is required prior to the submission of specimen.
c. The specimens are tested in CDC and confidential results are reported to the NJDHSS. Department will notify the physician and health officer of the results.
d. A confirmed case of HPS will require a detailed home site environmental assessment. This will be done in cooperation between the NJDHSS, local health agency, Department of Environmental Protection, Division of Fish and Wildlife, and CDC.

4) CONTROLLING FURTHER SPREAD

A. Isolation and Quarantine Requirements (N.J.A.C. 8:57-1.10)

None.

B. Protection of Contacts of a Case

None.

C. Managing Special Situations

Reported Incidence Is Higher Than Usual/Outbreak Suspected

If any cases of hantavirus infection are reported city/town or if an outbreak is suspected investigate to determine the source of infection and mode of transmission. An environmental assessment including: detection of rodent signs and identification of rodents present, points of rodent entry, and sources of food, water and harborage for rodents at the possible site(s) of exposure would be part of the investigation. Contact the NJDHSS Infectious and Zoonotic Diseases Program at 609.588.3121 as soon as possible. In the event a case is

confirmed by the Centers for Disease Control, the Program staff can help determine a course of action to conduct further surveillance and prevent additional cases.

D. Preventive Measures

Environmental Measures

The best way to prevent HPS is to eliminate or minimize human contact with rodents, particularly white-footed mice.

- Clear brush, grass, and garbage from around building foundations to eliminate a source of nesting materials. Keep tight-fitting lids on all garbage;
- Use metal flashing around the base of wooden, earthen or adobe dwellings to provide a strong metal barrier;
- Seal all entry holes ¼ inch wide or wider with lath screen or lath metal, cement, wire screening or other patching materials, inside and out;
- Elevate hay, woodpiles and garbage cans to eliminate possible nesting sites;
- For the control of mice inside a building, snap traps are recommended. Using bait such as peanut butter, place the traps perpendicular to the wall or other location used as a runway or harborage by the mice. For the control of rats, rodenticide baits are usually more effective. Use an EPA-approved rodenticide bait according to label directions, in a bait station or otherwise inaccessible to children and pets, along baseboards and behind harborage such as appliances. Properly dispose of dead rodents. Live trapping of rodents is not recommended. A certified pesticide applicator may also be hired to eliminate the infestation;
- Clean all food preparation areas. Store all food (both human and pet) in rodent-proof containers;
- Do not leave open bowls of pet food outside. Discard any uneaten pet food properly at the end of the day.

Personal Preventive Measures

People involved in cleaning rodent-contaminated areas should keep the following things in mind:

- Clean droppings using a wet method, rather than a dry method such as sweeping or vacuuming. Spray disinfectant, such as dilute bleach, prior to cleaning and use a wet mop or towels moistened with disinfectant to clean.
- Work in well-ventilated areas.
- Gloves, dust mist masks, long-sleeved clothing, and protective eyewear may help prevent exposure.

.

ADDITIONAL INFORMATION

Informational materials regarding hantavirus and rodent control may be obtained from the NJDHSS Infectious and Zoonotic Diseases Program.

A *Hantavirus Pulmonary Syndrome* Fact Sheet is available at the NJDHSS web site at <www.state.nj/health>.

Technical information about HPS is available from the Centers for Disease Control at www.cdc.gov/ncidod/diseases/hanta/hps/>.
Hantavirus pulmonary syndrome, disease information, NCID, CDC

The formal CDC surveillance case definition for Hantavirus Pulmonary Syndrome is the same as the criteria outlined in Section 2 A of this chapter. CDC case definitions are used by state health departments and CDC to maintain uniform standards for national reporting. For reporting to the NJDHSS, always use the criteria outlined in Section 2 A.

REFERENCES

American Academy of Pediatrics. 2000 Red Book: Report of the Committee on Infectious Diseases, 25th Edition. Illinois, Academy of Pediatrics, 2000.

CDC, Technical Information: All About Hantavirus. Available at web site: cdc.gov/ncidod

Chin, J., ed. Control of Communicable Diseases Manual, 17th Edition. Washington, DC, American Public Health Association, 2000.

Mandell, G., Benett J., Dolin R., Principles and Practice of Infectious Diseases. Churchill Livingstone, 2000.

Massachusetts Department of Public Health, Division of Epidemiology and Immunization. Guide to Surveillance and Reporting. Massachusetts Department of Public Health, Division of Epidemiology and Immunization, January 2001